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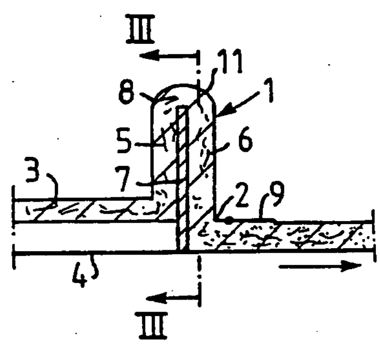
(54) Title: METHOD AND DEVICE FOR TRANSVERSE DISTRIBUTION OF A FLOWING MEDIUM



(57) Abstract

A method and a device for achieving uniform transverse distribution and spreading of a flowing medium, such as liquids, gases, foam or mixtures of different types of material. The device comprises a distribution housing (1) with a wide outlet opening (2) and line (3) for the medium feed. In a distribution chamber (5) the medium flow is deflected while being spread in lateral direction to a transversely curved passage (8) where the medium flow again is deflected to an outlet chamber (6). In this outlet chamber (6), which extends to the outlet opening (2), an outgoing substantially uniformly distributed and parallel flow is obtained.

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Method and device for transverse distribution of a flowing medium

This invention relates to a method and a device for spreading a flowing medium uniformly and distributing it in transverse direction. The medium can consist of, for example, liquids, gases, foam or mixtures of various types of materials.

As an example of application of the invention can be mentioned cellulose and the demand of the papermaking industry to form webs of fiber suspensions, which often exceed 10 m in width and have to meet very high requirements on uniformity both in transverse and longitudinal direction. The uniformity of the webs often is of decisive importance for the efficiency and economy of the process.

At the liquid treatment of fiber suspensions, for example, i.e. at their washing or bleaching and dewatering, it is, thus, essential that the pulp is supplied to and transversely distributed on a running liquid-permeable support as uniformly as possible both in transverse and longitudinal direction. It also is essential that the processing liquid is distributed uniformly across the pulp web. A uniform distribution prevents channelization and thereby uneven liquid treatment and dewatering.

In order to make optimum use of the apparatus equipment, a suspension of cellulose fibers to be dewatered, for example in connection with a liquid treatment, must be supplied at the highest possible concentration and formed on the support, through which liquid is sucked out. This support can be a perforated roll or a plane wire. The desired highest possible concentration is controlled by the capacity of the equipment to transversely distribute the medium with sufficient uni-

formity and to form a homogenous web to satisfy the demand of the process in question. The difficulty of distributing the fiber suspension uniformly across the entire width increases rapidly with increasing pulp concentration, due to the increasing shearing strength of the fiber network.

A non-uniform distribution of the fiber suspension not only results in non-uniform dewatering, and thereby yields a poor efficiency of the liquid treatment, but it also can cause damages on the fibers in a press and thereby deteriorate the pulp quality. In the nip between the rolls, for example in a press, fiber flocks and thick portions of the pulp web can be subjected to such high pressure forces that the fibers are damaged in these load-carrying portions.

It is, thus, obvious that a uniform distribution of the fiber suspension as well as of the processing liquid is of utmost importance for the quality of the final product and the economy of the process. Many different distribution devices have been developed for solving the aforesaid problems, but in many cases the problems yet remain, especially at sheet forming at high fiber concentrations.

The present invention implies that a further improved spreading and transverse distribution of a supplied flowing medium can be achieved. According to the invention, the medium flow is deflected in a transversely curved passage to an outgoing, substantially uniformly distributed and parallel flow. The passage can have a continuous or polygonic curving. Further characteristic features of the invention become evident from the attached claims.

The invention is described in greater detail in the following with reference to the accompanying drawings.

Fig. 1 shows a transverse distribution device according to the invention,
Fig. 2 is a section according to II-II in Fig. 1,
Fig. 3 is a section according to III-III in Fig. 2,
Figs. 4-6 show different embodiments of the device according to the invention.

The embodiment of the invention shown in Fig. 1 refers to a device for transverse distribution and forming of a pulp web of a fibrous material. The device comprises a distribution housing 1 with a wide, substantially rectangular outlet opening 2 and feed line 3 for the fiber suspension. The outlet opening can be directed angularly to or in parallel with a running liquid-permeable support 4, which can be, for example, a plane wire or a perforated roll.

The distribution housing 1 is formed with a distribution chamber 5, which is arranged substantially across the feed line 3 and extends from the connection of said line 3 diverging in a direction to a transversely curved passage with a deflection surface 11. The distribution housing 1 further comprises an outlet chamber 6, which extends in the opposite direction from the deflection at the passage 8 to the outlet 2. The two chambers 5,6 are separated by an inner wall 7 in the housing 1 and communicate with each other via the passage 8. This passage 8 curved in transverse direction, thus, is defined by the free end of the inner wall 7 and the deflection surface 11, which can have a shape curved continuously or polygonically in the transverse direction. Polygonic shape implies that the passage 8 is defined by a variety of substantially plane or straight portions, which together define the curving of the passage. The passage can also be assembled of a variety of portions of different curving.

The transversely curved deflection surface 11 can in the longitudinal direction preferably be curved with a certain radius. Alternatively, it can be plane or shaped in some other way in order to achieve special effects affecting the flow characteristic, for example to be more or less turbulent. The inner wall 7 can be formed so that the end defining the passage 8 has a shorter or longer extension in the medium flow direction. This end can have a rounded or abrupt configuration. The dimensioning of the passage 8, i.e. the configuration of the deflection surface 11 and the end of the wall 7 must be adapted to the requirements of the process and final product.

The passage 8 curved in transverse direction must be formed so that the flowing medium from the distribution chamber 5 is deflected in the passage 8 to the outlet chamber 6 to a substantially uniformly distributed and parallel flow. This can be achieved by forming the curved passage 8 so that its height _h_ is between 1/8 and 1/2, preferably about 1/4 of its width _b_, and that the outlet opening 2 has the same width as the passage 8. The inlet of the feed line 3 to the distribution chamber 5 shall be located approximately at the centre of the width of the distribution chamber and at a distance from the passage 8 between 1/8 and 1/2, preferably about 1/4 - 1/3, of the width _b_ of the passage 8.

The passage 8 preferably is shaped substantially as a parabola, and the feed line 3 is located in connection to the focus of the parabola. Alternatively, the passage 8 can substantially have the shape of an arc. The feed line 3 then is placed in connection to the centre of the chord of the arc at a distance to the passage 8 of about 1/4 of the chord length, i.e. the width _b_ of the passage.

At, for example, high concentration forming of a pulp web consisting of a long-fiber cellulose pulp, the fiber suspension can be supplied through the feed line 3 at a fiber concentration of up to 12%, preferably 5-10%. The flow rate then can be 5-50 m/s, preferably 8-20 m/s. The fiber suspension entering the distribution chamber 5 meets the inner wall 7 of the housing 1 and is deflected thereby. The high rate of the fiber suspension at the impact on the partition wall 7 brings about a zone of high energy intensity whereby the fiber network is disintegrated and the pulp is fluidized. The suspension is spread from the inlet at a decreasing rate outward in the diverging distribution chamber 5 to the passage 8 where it is again deflected to the outlet chamber 6, through which the suspension flows substantially in parallel and at a constant rate to the outlet opening 2 and support 4.

Especially when the passage 8 is shaped as a parabola, and the pulp is supplied in connection to the focus of the parabola and is spread outward from there, every portion of the flow will be deflected in the passage 8 to a spread parallel flow substantially perpendicular to the outlet 2. Every portion of the flow will have a substantially equally long path from the connection of the feed line 3 via the passage 8 to the outlet 2, irrespective of the direction in the distribution chamber 5. This implies, that the pressure drop from the inlet to the outlet is constant across the entire width of the outlet 2 and thereby ensures a uniform distribution of the medium across the entire width. In practice, substantially the same effect can be achieved even when the passage 8 has a curving other than that described above.

It may also be suitable to form the curving of the passage 8 so that the medium flow supplied and spread in the distribution chamber over 180° is so deflected in the passage 8,

that each of the sectors of equal size of the spread flow feeds corresponding equally wide portions of the outlet 2. Such a curve shape can be described generally by the formula

$$y = \frac{X}{\tan\left(\frac{\pi \cdot X}{b}\right)}$$

The maximum height h then is $\frac{b}{\pi}$. The passage 8 then can have a shape which is curved continually or polygonically, or which is assembled of a variety of differently curved portions.

The outlet opening 2 possibly can be provided with a movable or flexible lip 9 extending a distance from the distribution house 1 in order to additionally stabilize the pulp web formed.

The feed line 3 can be given a semi-circular cross-section where the flat side of the line remote from the passage 8.

In Fig. 4 an embodiment of the invention is shown where the fiber suspension is applied in parallel with the movement of the liquid-permeable support 4. Compared with the embodiment shown in Fig. 1, Fig. 4 differs even in that the opposite side of the pulp web is laid against the support, i.e. that side which faces the deflection surface 11 in the passage 8.

In Fig. 5 an embodiment is shown where the fiber suspension is supplied from below and applied on a curved surface, for example a roll. The passage 8 here is defined by a plane deflection surface 11.

The embodiment according to Fig. 6 corresponds to Fig. 5, but the roll here rotates in the opposite direction, and the outlet 2 is directed downward.

The invention has been illustrated as a device for distributing a pulp suspension, but it is obvious that the invention can be applied also to other flowing media where a uniform transverse distribution is tried to be obtained. One example thereof is the supply of processing liquid across a material web.

The invention, thus, is not restricted to the embodiments set forth above, but can be varied within the scope of the invention idea.

Claims

1. A method of achieving a uniform transverse distribution and spreading of a flowing medium, such as liquids, gases, foam or mixtures of different types of materials, c h a r a c t e r i z e d i n that the medium in the form of a flow is deflected while being spread in lateral direction and thereafter again is deflected in a passage (8) curved in transverse direction to an outgoing substantially uniformly distributed and parallel flow.

2. A method as defined in claim 1, c h a r a c t e r i z e d i n that the curved passage (8) substantially has the shape of a parabola, and that the medium is supplied and deflected in connection to the focus of the parabola.

3. A method as defined in claim 1, c h a r a c t e r i z e d i n that the curved passage (8) substantially has the shape of an arc, and that the medium is supplied and deflected in connection to the centre of the chord of the arc where the distance to the passage (8) is about 1/4 of the chord length.

4. A method as defined in claim 1, c h a r a c t e r i z e d i n that the medium is so deflected in the passage (8) that each of the sectors of equal size of the laterally spread medium flow feeds corresponding portions of equal width of the outgoing flow.

5. A method as defined in any one of the claims 1-4, c h a r a c t e r i z e d i n that the outgoing parallel medium flow is spread on a movable support in a direction forming an angle with the support.

6. A method as defined in any one of the claims 1-4, c h a r a c t e r i z e d i n that the outgoing parallel medium flow is spread on a movable support in a direction in parallel with the support.

7. A device for uniform transverse distribution and spreading of a flowing medium, such as liquids, gases, foam or mixtures of different types of materials, comprising a distribution housing (1) with a wide outlet opening (2) and a line (3) for the feed of the medium, c h a r a c t e r i z e d i n that the distribution housing (1) is formed with a distribution chamber (5), which is arranged substantially transverse to the feed line (3) and extends from the connection of said line diverging to a transversely curved passage (8), and an outlet chamber (6) extending in the opposite direction from the passage (8) to the outlet opening (2), which two chambers (5,6) commun- icate with each other via the passage (8) so that the medium is deflected to an outgoing substantially uniformly distributed and parallel flow.

8. A device as defined in claim 7, c h a r a c t e r i z e d i n that the two chambers (5,6) are separated by an inner wall (7), the end of which together with a deflection surface (11) in the housing (1) forms the passage (8).

9. A device as defined in claim 7 or 8, c h a r a c t - e r i z e d i n that the height (h) of the curved passage (8) is between 1/8 and 1/2, preferably about 1/4, of its width (b), and that the width of the outlet opening (2) corresponds to the width of the curved passage (8).

10. A device as defined in any one of the claims 7-9, c h a r a c t e r i z e d i n that the inlet of the feed line (3) to the distribution chamber (5) is located approximately at the centre of the width of the distribution chamber (5) and at a distance from the passage (8) between 1/8 and 1/2 of the width (b) of the passage (8).

11. A device as defined in any one of the claims 7-10, c h a r a c t e r i z e d i n that the curved passage (8) substantially has the shape of a parabola, and the inlet of the feed line (3) is located in connection to the focus of the parabola.

12. A device as defined in any one of the claims 7-10, c h a r a c t e r i z e d i n that the curved passage (8) substantially has the shape of an arc, and the inlet of the feed line (3) is located at a distance from the passage (8) of about 1/4 of the width (b) of the passage.

13. A device as defined in any one of the claims 7-10, c h a r a c t e r i z e d i n that the curved passage (8) substantially has a curving which can be described by the formula

$$y = \frac{X}{\tan\left(\frac{\pi \cdot X}{b}\right)}$$

and the inlet of the feed line is located at a distance from the passage (8) of about b/π of the passage width (b).

14. A device as defined in any one of the claims 7-13, c h a r a c t e r i z e d i n that the feed line (3) has a semi-circular cross-section, with the flat side remote from the passage (8).

15. A device as defined in any one of the claims 7-14, c h a r a c t e r i z e d i n that a movable support (4) is provided at the outlet opening (2), and the outlet opening is directed at an angle between 0 and 90° to the support (4).

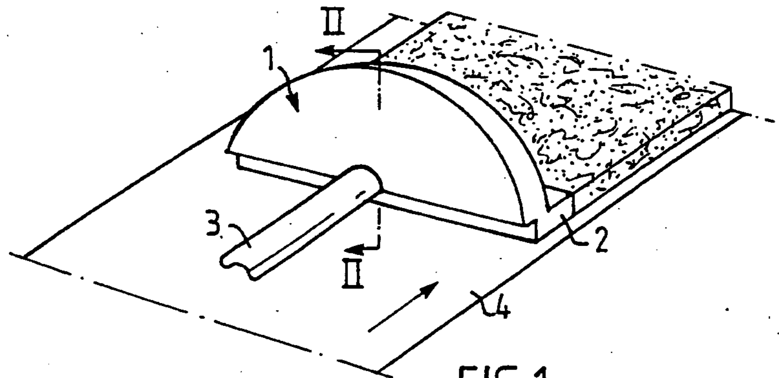

FIG.1

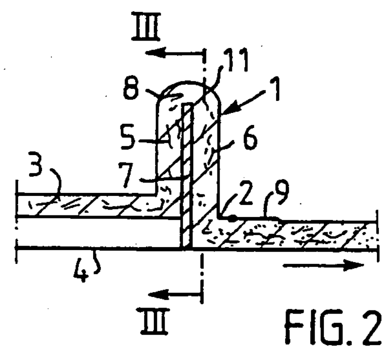

FIG. 2

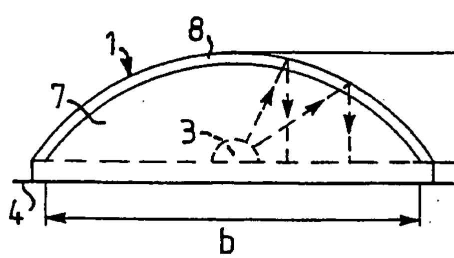

FIG.3

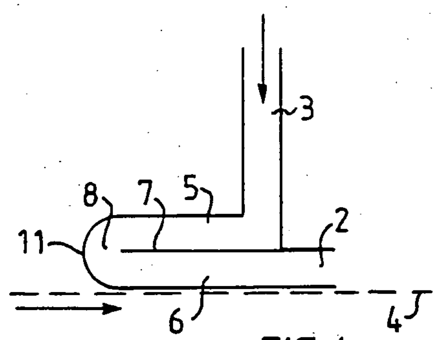

FIG.4

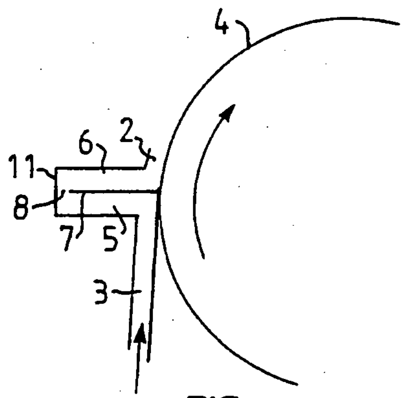

FIG.5

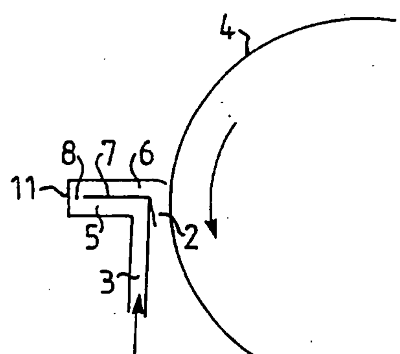

FIG.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 93/00807

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: D21F 1/02, F15D 1/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, B2, 2232074 (STAL REFRIGERATION AB), 20 October 1977 (20.10.77), figures 1-2 --	1,7
A	DE, C2, 2620033 (ST. ANNE'S BOARD MILL CO. LTD), 1 July 1982 (01.07.82), figures 1-6 -- --------	1,7

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
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International application No.
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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